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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
NOLAN, PETER D	

ART UNIT	PAPER NUMBER
4155	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/546,625	HECKER ET AL.	
	Examiner	Art Unit	
	Peter D. Nolan	4155	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *8-22-05*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *13-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *13-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8-22-05*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 8/22/05 has been received and placed of record in the file.

Claim Objections

1. Claim 26 objected to because of the following informalities: the word "integrating" should be changed to "integrated". Appropriate correction is required.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 13-17, 21, 22, 24, 25 are rejected under 35 U.S.C. 103(a) as being anticipated by Hayakawa et. al (US 6347269 B1) in view of Crapanzano et. al (US 4773013).

3. Regarding claim 13, Hayakawa teaches a method for effecting a computer-aided estimation of a mass of a vehicle, comprising: high pass filtering an equilibrium relationship, between a motive force and a sum of an inertial force and drive resistances, in which the mass and a gradient angle of a roadway are included as

quantities, with respect to time, assuming a constant gradient angle; and calculating at least one of (a) the mass of the vehicle and (b) a reciprocal value of the mass of the vehicle from the equilibrium relationship passed through a high pass filter (see Hayakawa abstract which discloses an invention to determine the mass of a vehicle using the acceleration of the vehicle and the driving force wherein high pass filtering of the acceleration and driving force signals is used to remove the influence of a road gradient. See also column 5, lines 5-15 where the equilibrium relationship "$\underline{\alpha} = \underline{F}/(\theta m) - g \sin \underline{\Theta}$" can be used to obtain the mass M of a vehicle. $\underline{\alpha}$ is the acceleration deducted by a signal of a lower frequency, $\underline{F}$ is the driving force deducted by a lower frequency, g is gravity and $\underline{\Theta}$ is the change in the gradient deducted by a lower frequency. In column 4, lines 42-49 the vehicle mass is defined as $M = \theta m$ where m is the initial vehicle mass and θ is a vehicle mass variable parameter).

4. However, while Hayakawa teaches where the equilibrium relationship is passed through a high pass filter, it does not explicitly teach where the equilibrium relationship is computer differentiated with respect to time.

5. Crapazano teaches an antiskid control system for a vehicle that uses a high pass filter to determine the derivative of the deceleration of the vehicle (see Crapazano column 6, lines 62-68 and column 7, lines 1-5 where the wheel speed of an aircraft is passed through a first differentiator to determine the deceleration of an aircraft, i.e. the first derivative of the wheel speed, which is then passed through a second differentiator to determine the rate of change of deceleration, i.e. the second derivative of the wheel speed. Both differentiators are high pass filters. Although Crapazano teaches where

only the derivative of the deceleration is determined, the high pass filtering is equally applicable to determine the derivative of the acceleration or the force).

6. It would be obvious to one skilled in the art to use the high pass filter as taught in Hayakawa to differentiate the equilibrium relationship with respect to time because a high pass filter may be used to determine the derivative of a value and determining the derivative of a value is well known in the art as taught in Crapazano (see Crapazano column 6, lines 62-68 and column 7, lines 1-5).

7. Regarding claim 14, Hayakawa, as modified by Crapazano in claim 13, teaches where the where the vehicle includes a commercial vehicle (see Hayakawa column 1, lines 18-33 where it is explained that the mass of commercial vehicles may vary significantly and it is therefore preferable to treat vehicle mass as a variable).

8. Regarding claim 15, Hayakawa, as modified by Crapazano in claim 13, teaches where the drive resistances include a sum of one of (a) an accelerative force and (b) a deceleration force as a function of the mass and one of (a) an uphill force and (b) a downhill force as a function of the gradient angle (see the rejection of claim 13 above).

9. Regarding claim 16, Hayakawa, as modified by Crapazano in claim 13, teaches where the mass is calculated from the equation: m = (dF/dt) / (da/dt) wherein a represents a time derivation of a longitudinal vehicle velocity and F represents the motive force of the vehicle (see Hayakawa column 6, lines 26-38 where the mass can be determined from equation 5 "$\underline{\alpha}(k) = \underline{F}(k)/(\theta m) + e(k)$" where $\underline{\alpha}$ is the acceleration deducted by a signal of a lower frequency, $\underline{F}$ is the driving force deducted by a lower frequency, k is a sampling time interval, θm is the vehicle mass, and e is the residual

error due to the gradient. In instances where e(k) is negligible it can be ignored and rearranging equation 5 will give $\theta m = \underline{F}(k)/\underline{\alpha}(k)$. See the rejection of claim 13 above regarding determining the derivative using a high pass filter).

10. Regarding claim 17, Hayakawa, as modified by Crapazano in claim 13, teaches where the method further comprises determining, from measured quantities, the motive force and the one of (a) the acceleration and (b) the deceleration (see Hayakawa figure 6, acceleration sensor 30, throttle valve sensor 12, engine rotation speed sensor 14, shift sensor 18, vehicle speed sensor 20. See also column 7, lines 18-58 where gross driving force calculation section 26 calculates the driving force by subtracting the running resistance force calculated by running resistance calculation section 20, which is based in part on the output of sensor 22, from the engine driving force calculated from engine force calculating section 10, which is based in part on the outputs of sensors 12, 14, and 18, and 20).

11. Regarding claim 21, Hayakawa, as modified by Crapazano in claim 13, teaches where the computer-aided differentiating is performed continuously and recursively (see Hayakawa column 6, lines 26-60 where a least squares method may be sequentially employed for estimating a parameter θ).

12. Regarding claim 22, Hayakawa, as modified by Crapazano in claim 13, teaches where the computer-aided differentiating is performed one of (a) according to a two-point differentiation and (b) with a state-variable filter (see rejection of claim 13 regarding differentiation).

13. Regarding claim 24, Hayakawa teaches a device for effecting a computer-aided estimation of a mass of a vehicle, comprising: a calculation unit adapted to calculate at least one of (a) the mass of the vehicle and (b) a reciprocal value of the mass of the vehicle from an equilibrium relationship between a motive force and a sum of an inertial force and drive resistances, the mass and a gradient angle of a roadway included as calculation quantities, after a high pass filtering of the equilibrium relationship with respect to time, assuming a constant gradient angle (see Hayakawa abstract which discloses an invention to determine the mass of a vehicle using the acceleration of the vehicle and the driving force wherein high pass filtering of the acceleration and driving force signals is used to remove the influence of a road gradient. See also column 5, lines 5-15 where the equilibrium relationship "$\underline{\alpha} = \underline{F}/(\theta m) - g \sin \underline{\Theta}$" can be used to obtain the mass M of a vehicle. $\underline{\alpha}$ is the acceleration deducted by a signal of a lower frequency, $\underline{F}$ is the driving force deducted by a lower frequency, g is gravity and $\underline{\Theta}$ is the change in the gradient deducted by a lower frequency. In column 4, lines 42-49 the vehicle mass is defined as $M = \theta m$ where m is the initial vehicle mass and θ is a vehicle mass variable parameter).

14. However, while Hayakawa teaches high pass filtering of the equilibrium relationship, it does not explicitly teach differentiating the equilibrium relationship.

15. Crapazano teaches an antiskid control system for a vehicle that uses a high pass filter to determine the derivative of the deceleration of the vehicle (see Crapazano column 6, lines 62-68 and column 7, lines 1-5 where the wheel speed of an aircraft is passed through a first differentiator to determine the deceleration of an aircraft, i.e. the

first derivative of the wheel speed, which is then passed through a second differentiator to determine the rate of change of deceleration, i.e. the second derivative of the wheel speed. Both differentiators are high pass filters. Although Crapazano teaches where only the derivative of the deceleration is determined, the high pass filtering is equally applicable to determine the derivative of the acceleration or the force).

16. It would be obvious to one skilled in the art to use the high pass filter as taught in Hayakawa to differentiate the equilibrium relationship with respect to time because a high pass filter may be used to determine the derivative of a value and determining the derivative of a value is well known in the art as taught in Crapazano (see Crapazano column 6, lines 62-68 and column 7, lines 1-5).

17. Regarding claim 25, Hayakawa, as modified by Crapazano in claim 24, teaches where the vehicle includes a commercial vehicle (see Hayakawa column 1, lines 18-33 where it is explained that the mass of commercial vehicles may vary significantly and it is therefore preferable to treat vehicle mass as a variable).

18. Claims 18-20, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayakawa et. al (US 6347269 B1) in view of Crapazano et. al (US 4773013) and further in view of Zhu et. al (US 6167357).

19. Regarding claim 18, Hayakawa, as modified by Crapazano in claim 13, does not explicitly teach where the measured quantities are available in a control unit of the vehicle.

20. Zhu teaches where the measured quantities are available in a control unit of the vehicle (see Zhu figure 1, control system 10, vehicle speed sensor 24, accelerometer

46, accelerator pedal 26, fuel system 30 and control computer 12. See also column 8, lines 21-33 where it is disclosed that control computer 12 continually senses data from the sensors and devices of control system 10 to determine vehicle speed and vehicle push force).

21. It would be obvious to one skilled in the art for the measured quantities taught by Hayakawa to be available in a control unit of the vehicle as taught in Zhu because an engine control system typically includes sensors and logic for determining driving force and acceleration.

22. Regarding claim 19, Hayakawa, as modified by Crapazano 13 and further modified by Zhu in claim 18, does not teach where the method further comprises filtering the measured quantities as a function of a signal quality.

23. Zhu teaches where the measure quantities of acceleration and drive force are filtered as a function of signal quality (see Zhu figure 2, stage 110 where a determination is made whether data is qualified. See also column 10, lines 65-67 and column 11 lines 1-17 where data must meet threshold conditions to be determined to be qualified data. Conditions may be imposed in order to minimize road conditions, etc.).

24. It would be obvious to one skilled in the art to add the step of filtering the measured values of acceleration and drive force as taught in Zhu to the method of calculating vehicle mass taught in Hayakawa because filtering measured quantities as a function of the signal quality ensures that the data is capable of being reliably used to estimate vehicle mass (see Zhu column 11, lines 11-17).

25. Regarding claim 20, Hayakawa, as modified by Crapazano in claim 13, does not teach where the method further comprises: repeatedly measuring the measured quantities; and weighting the measurements differently.

26. Zhu teaches where a method for estimating vehicle weight includes a step for repeatedly measuring the measured quantities and weighing the measurements differently (see Zhu method 100 showing repeated measurement of the data points in step 104. See also column 10, lines 46 through 67 and column 11, lines 1-17 where the speed, push force, and shift status are stored in three separate buffer blocks and then the buffered data is qualified to certain threshold requirements, such as a shift status equal to 0 and a vehicle acceleration greater than a predetermined threshold. See further column 11, lines 18-38 where the data that meet the threshold requirements are determined to be qualified data and are grouped with surrounding data points in order to define a segment of consecutive qualified data points. The longest qualified data segment is selected to determine the vehicle mass).

27. It would be obvious to one skilled in the art to add the step of repeatedly measuring the acceleration and drive force and weighing the measurements differently as taught in Zhu to the method of calculating vehicle mass taught in Hayakawa because this ensures that the data is capable of being reliably used to estimate vehicle mass (see Zhu column 11, lines 11-17).

28. Regarding claim 26, Hayakawa, as modified by Crapazano in claim 24, does not explicitly teach where the calculation unit is integrating into a control unit of the vehicle.

29. Zhu teaches where a mass calculation unit is integrated into a control unit of a vehicle (see Zhu figure 1, control system 10, vehicle speed sensor 24, accelerometer 46, accelerator pedal 26, fuel system 30 and control computer 12. See also column 8, lines 21-33 where it is disclosed that control computer 12 continually senses data from the sensors and devices of control system 10 to determine vehicle speed and vehicle push force and column 3, lines 58-62 where engine control system 10 is adapted to calculate mass).

30. It would be obvious to one skilled in the art to integrate the vehicle mass calculation unit in Hayakawa into a control unit of a vehicle as taught in Zhu because an engine control system typically includes sensors and logic for determining driving force and acceleration. A mass calculation unit that is separate from the control unit would add cost and complexity to the vehicle with no added utility.

31. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayakawa et. al (US 6347269 B1) in view of Crapazano et. al (US 4773013) and further in view of Mori (US 6745112 B2), Randal et. al (V. T. Randal, J. L. Schmalzel, and A. P. Shepard, “Floating-Point Computation Using a Microcontroller,” Proceedings of the Annual International Conference of the IEEE, 1988, pp 1243-1244, vol. 3), Predko (M. Predko, *Programming and Customizing the PIC Microcontroller*. New York, NY: McGraw-Hill, 1998), and Bellinger et. al (US 6567734 B2).

32. Regarding claim 23, Hayakawa, as modified by Crapazano in claim 13, teaches where the calculating step includes calculating the mass (see rejection of claim 13 above).

33. However, Hayakawa does not teach where the method further comprises calculating the reciprocal of the mass or forming a weighted average value.

34. Mori teaches where mass is used in the calculation of vehicle parameters, specifically where mass is used as a divisor (see Mori figures 4 and 9A where a vehicle a vehicle side slip angle is estimated in part by calculating a vehicle side slip angle differential using equation 6 which uses mass as a divisor).

35. Randal and Predko teach where using a reciprocal of a value as a multiplier can be more efficient than using the value itself as a divisor (see Randal page 2, column 1 where an 8051 microprocessor running floating point routines required 450 cycles to run a typical multiplication operation and 1070 cycles to run a typical division operation. See also Predko pages 302-304 for pseudo-code representing multiplication and division in a microcontroller where multiplication requires fewer steps than division. It is well known in the art that division in a microprocessor typically requires more computational resources than multiplication. Therefore, in situations where a value is repeatedly used as a divisor, it is more efficient to determine the reciprocal and use it as a multiplier).

36. It would be obvious to one skilled in the art to calculate the reciprocal value of the mass in Hayakawa because reducing computational load when determining a vehicle dynamic which require mass as a variable, such as the side slip angle, is desirable (see Mori column 1, lines 59-64 where conventional side slip angle estimation methods are problematic due to the increase in the computational load) and calculating the inverse of the mass and using it as a multiplier in algorithms which call for it to be used repeatedly

as a divisor would reduce the computational load (see Mori figure 4, equation 6. Solving equation 6 using mass would require three division operations whereas solving equation 6 using the reciprocal of mass would require one division operation to find the reciprocal of the mass and 3 multiplication operations. The latter method would be more efficient, as shown by Randal and Predko).

37. Bellinger teaches a method for estimating a vehicle mass where the method further comprises forming a weighted average value (see Bellinger column 22, lines 49-67 and column 23, lines 1-26 where a vehicle mass estimate is computed as a weighted average of the samples contained in a register holding a predefined number of instantaneous vehicle mass samples).

38. It would be obvious to one skilled in the art to add a step forming a weighted average value of the estimated mass as taught in Bellinger to the method of determining vehicle mass taught in Hayakawa because weighted averaging is well known in the art (see Bellinger column 22, lines 21-25 where it is explained that those skilled in the art will recognize other known techniques for computing the estimated vehicle mass as an average, weighted or otherwise, of at least some of the instantaneous vehicle mass samples).

Conclusion

Any inquiry concerning this or any earlier communication from the examiner should be directed to Examiner Peter Nolan, whose telephone number is 571-270-7016. The examiner can normally be reached Monday-Friday from 7:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thu Nguyen, can be reached at 571-272-6967 or 571-270-1202. The fax number for the organization to which this application or proceeding is assigned is 571-274-3713.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Peter D Nolan/

Examiner, Art Unit 4155

/Thu Nguyen/
Supervisory Patent Examiner, Art Unit 4155